

Gul, V. E.

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4630. Influence of natural rubber oxidation on the kinetics of swelling. V. E. Gul, A. V. Khodzhaeva, and B. A. Dogadkin, *Colloid J., U.S.S.R.*, 1954, 16, 393-8. In English. Fresh butadiene-styrene rubber containing an antioxidant (Neozone D) swelled in methanol and ethanol; its mass reached a constant value of about 1.23 to 1.25 times the initial mass in 30 or 60 h, respectively. After ageing for  $t$  days at 80°C butadiene-styrene rubber swelled for days without reaching a constant weight and the swelling after 8 days was greater, and after 15 and 23 days was less than for fresh butadiene-styrene rubber. Apparently, oxidative breakdown of chains prevailed up to 8 days, while later the fragments grew together to branched chains. This was confirmed by molecular weight determinations. When Neozone D and soluble products were removed from fresh butadiene-styrene rubber by methanol (in 10 days), swelling in methanol became limitless and almost as great as after  $t=8$ .

Fresh smoked-sheet rubber had a swelling limit in methanol (e.g. 1.00 the initial mass), which disappeared when the rubber was heated for several days at 80°C or purified by dissolving in benzene and precipitating. The increase of swelling after ageing was due to accumulation of oxidation products in the rubber; this accumulation was demonstrated also by the shortening of the induction period for air oxidation of smoked-sheet rubber at 143°; the induction period was 10 h, 4 h, and 0 h for fresh smoked-sheet rubber and smoked-sheet rubber after 9 and 20 days' ageing, respectively. The molecular weight of fresh smoked-sheet rubber was 380,000 by both methods; after 20 days' ageing it was 100,000 (light-scattering method) or 210,000 (viscosity method). 03461

GUL', V.Ye.; KHODZHAYEVA, I.V.; DOGADKIN, B.A.

Effect of the oxidation of rubbers on the kinetics of their swelling.  
Koll.shur. 16 no.6:412-420 H-D '54. (MLRA 7:12)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii im. Lomono-  
sova.

(Rubber)

GUL, V. Ye.

W.D.D.R.  
The role of molecular forces in the mechanism of swelling  
of high polymers. II. Kinetics of swelling. V. E. Gul  
(Moscow, U.S.S.R. Chem. Technol., Moscow). Rubber  
Chem. & Technol. 1, 66-74, 1968. See C.A. 47, 9123f.  
C. C. Davis

GUL', V. E.

USSR/Physics

Card : 1/1

Authors : Gul', V. E.

Title : Theory of durability (of materials)

Periodical : Dokl. AN SSSR, 96, Ed. 5, 953 - 956, June 1954

Abstract : The article analyses durability of various materials, its dependance on speed of deformation or time length during which one or the other material remains under a pressure. Mathematical formulas are given expressing the durability (of materials) with respect to the speed of deformation and to temperature. An expression is given which shows dependance of duration of resistance to a break on stress. Durability of elastic materials are also analyzed. Diagrams.

Institution : The M. V. Lomonosov Institute of Fine Chemical Technology, Moscow

Presented by : Academician, V. A. Kargin, March 2 1954

GUL', V. Ye.

GUL', V. Ye. --"Effect of Intermolecular Interaction on Physical, Chemical, and Mechanical Properties of Latex and Rubber." \*(Dissertations for Degrees in Science and Engineering Defended at USSR Higher Educational Institutions) Min of Higher Education, USSR. Moscow Inst for Microchemical Technology imeni M. V. Lomonosov, Moscow, 1955

SO: Knizhnaya Letopis', No. 25, 18 Jun 55

\* For Degree of Doctor of Chemical Sciences

USSR/Chemistry - Elastomers

FD-2725

Card 1/1

Pub. 50 - 6/20

Authors : Khodzhayeva, I. V., Gul', B. Ye., Dogadkin, B. A.

Title : Methods for the evaluation of the quality of butadiene-styrene rubbers

Periodical : Khim. prom. No 5, 272-277, Jul-Aug 1955

Abstract : Propose two methods for the evaluation of the quality of the butadiene-styrene rubber SKS-30: on the basis of the non-equilibrium elasticity modulus of the crude rubber at 100% elongation ( $M_{100}$ ) and on the basis of the index of creeping. Five graphs, 3 tables. Six references; 3 USSR, all since 1940.

Institution : Moscow Institute of Fine Chemical Technology imeni M. V. Lomonosov

Gul, V.E.

✓ Effect of molecular interaction on the light scattering of VLT  
rubber solutions. V. E. Gul and G. S. Khtenik (Inst. Fine  
Chem. Technol., Moscow). Rubber Chem. and Technol. 8,  
494-503(1965)(in English).—See C.A. 48, 11827d.  
C. C. Davis

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USSR

✓ Effect of molecular interaction on the kinetics of swelling of elastomers. V. E. Gul and A. G. Shvarts (Leningrad Univ. Eng. Chem. Technol., Moscow). *Kolloid. Zhur.* 17, 24-30; *Colloid J. (U.S.S.R.)* 17, 21-5 (1955) (Engl. translation); cf. preceding abstr. When a rubber was immersed in a liquid to swell, its wt. became a linear function of time after a period  $t$ . This  $t$  was, at room temp., for a vulcanizate (I) of smoked-sheet rubber 25, 48, and 193 hrs. for swelling in MeCOEt, EtOH, and MeOH, resp.; the difference between the  $\Delta \rho$  of the cohesion energy of I and the solvent also increased from MeCOEt to MeOH. At 63°,  $t$  for a vulcanizate (with 0.5% S) of butadiene-acrylonitrile polymer (II) and a vulcanizate (0.5% S) of butadiene-styrene polymer (III) in di-Bu sebacate (IV) was 156 and 108 hrs., resp.; and the difference between the  $\rho$  of II and IV was greater than that between III and IV. Thus the rate of swelling is greater the smaller the difference between the  $\rho$  of the polymer and solvent. The greater the swelling, the more rapidly  $t$  decreased with rise of temp. Thus,  $t$  for III in IV (large swelling) decreased from 136 to 90 hrs., while  $t$  for III in di-Bu phthalate (moderate swelling) decreased from 48 to 20 hrs. between 40 and 60°. J. J. B.



*Got GUL VE*

U S S R

3071. Effect of molecular interaction on light scattering properties of rubber solutions. V. E. GUL and G. S. KLITENIK. *Rubb. Chem. Technol.*, 1953, 28, 404-503; *Colloid J., U.S.S.R.*, 1954, 16, 170-84; *Chem. Abs.*, 1956, 49, 5015. Cf. this journal, 1956, abs. 1815. English translations of this article now appear. 33465 *gr*

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Effect of intermolecular interaction and temperature on the  
relative elongation of n-alkanes at rupture. V. P. Gul  
and L. I. Barinova. *Colloid J. (U.S.S.R.)* 18, 601-2  
(1956) (English translation). — *Sci. C.A.* 31, 62013.  
B. M. F.

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Gal, U. E.

Effect of the intermolecular interaction and temperature on the relative elongation of vulcanizates at rupture. V. P. Gut and L. I. Eshizova (M. V. Lomonosov Inst. of Chem. Technol., Moscow). *Kolloid. Zh.* 18, 600-6 (1956); cf. *CA* 49, 15332d. — The stress-strain curves of the vulcanizates of 3 synthetic rubbers containing apparently 25%, 26%, and 40% nitrile, resp., were very similar but ended at lower rupture stress  $\sigma_r$  and lower elongation  $\epsilon_r$  the smaller was the nitrile content  $n$ . The effect of  $n$  was less at higher temps., e.g., for  $n = 18$ ,  $\sigma_r$  and  $\epsilon_r$  were 115 kg./sq. cm. and 310% at 20° and 65 and 200% at 73°, and for  $n = 40$ ,  $\sigma_r$  and  $\epsilon_r$  were 230 kg./sq. cm. and 640% and 70 and 230% at 28° and 76°, resp. An equation was derived for the effect of temp. on  $\epsilon_r$ ; it contained the cohesive energy  $U$  of the vol. in which rupture occurred;  $U/R$  was 1100 and 3600 for  $n = 18$  and 40, resp.;  $R$  is the gas constant.

J. J. Hinken

GUL', V.Ye.

The breaking mechanism of high polymers. Usp. khim. i tekhn. polim.  
no.2:202-221 '57. (MIRA 11:1)  
(Polymers) (Chemical reaction--Mechanism)

GUL', V.Ya.; KRUTETSKAYA, G.P.; KOVRIGA, V.V.

Investigating the mechanism of the rupture of vulcanizates. Kauch.  
i rez. 16 no.12:1-7 D '57. (MIRA 11:3)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii im. M.V.  
Lomonosova.

(Rubber--Testing) (Deformations (Mechanics))

GUL, V.E.

Effect of swelling on the strength of vulcanizates. I. I. Dzagachin, D. L. Fedyukin, and V. E. Gul (Inst. Phys. Chem., Technol. Moscow), *Kolloid. Zhur.* 19, 289-292 (1957); cf. *C.A.* 49, 6155b. The tensile strength  $\sigma$  and the total elongation  $\Delta$  of vulcanizates usually decreased when a plasticizer was added, either by immersing the vulcanizate in it or by mixing it during mastication; but both  $\sigma$  and  $\Delta$  showed a max. when a few % of  $C_{12}H_{25}CO_2Bu$  (I) or di-Bu sebacate (II) were added to a rubber vulcanizate, or  $C_{12}H_{25}CO_2Me$  (III) to SEB-30 (a butadiene-styrene copolymer), or I, II, III, or  $C_{12}H_{25}CO_2C_6H_5$  was added to a butadiene-acrylonitrile copolymer (IV) (60/40). The amt. of I corresponding to the max. of  $\sigma$  was approx. equal to that which lowered the glass temp. of a IV to the lowest level ( $-52^\circ$ ) not affected by further addn. of I. A max. of  $\sigma$  and  $\Delta$  occurs when the nonplasticized vulcanizate is so rigid that its mol. chains do not orient themselves during stress application; small addn. of plasticizer increases the flexibility of chains, while a large addn. weakens the intermol. forces and lowers  $\sigma$  again. F. J. Hixman

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Gul, V. Ye

The effect of the intramolecular interaction on the properties of rubber solutions. V. B. Gul and V. A. Pervostney (M. V. Lomonosov Inst. Eng. Chem., Moscow). *Kolloid Zhur.* 19, 553-5 (1957); *Ch. C.A.* 49, 73/8. Three butadiene-CH<sub>2</sub>:CHCN rubbers (I) contg. 16-40% nitrile were fractionated, and each fraction (whose mol. wt. varied between 25,000 and 145,000) was vulcanized with S 2, Sulfenamide BT 1.8, ZnO 5, stearic acid 2, and Neozon D 1 part for 100 parts I. The swelling of the vulcanizates had a max. near the specific cohesion energy of 0-4.8 cal./cm.<sup>2</sup> Et<sub>2</sub>O, AcOAm, AcOPr, PrCHO, AcOEt, MeCOEt, HCO<sub>2</sub>Et, AcOMe, COMe, and MeCN were the liquids. The degree of cross-linking (calcd. from the equl. modulus of elasticity) was almost equal for all vulcanizates. The intrinsic viscosities of the solns. of nonvulcanized fractions in MeCOEt were extrapolated to zero concn. The characteristic viscosity  $[\eta]$  thus obtained was a function of  $[d\rho/dx]$ , i.e. of the gradient of velocity extrapolated to zero concn., according to  $\log [\eta] = \text{const.} + B[d\rho/dx]$ . The const. B was for I contg. 26% nitrile greater than for those contg. 18% and 40% nitrile.

J. F. Blizman

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GUL', V.Ye.; KRUTETSKAYA, G.P.

Experimental investigation of highly elastic polymer specimens to establish a relationship between the rate of their rupture process and rate of deformation. Dokl. AN SSSR 114 no.5:973-975 Je '57.  
(MLRA 10:9)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii im. M.V. Lomonosova. Predstavleno akademikom V.A. Karginym.  
(Polymers) (Deformations (Mechanics))

GUL', V. Ye., Doc Chem Sci -- (diss) "Effect of intermolecular reaction upon the physicochemical and mechanical properties of caoutchouc and rubber." Mos, 1958. 25 pp (Min of Higher Education USSR, Mos Inst of Fine Chemical Engineering im M. V. Lomonosov). List of author's works pp 23-25 and bibliography: pp 22-23 (KL, 17-58, 105)

-6-

GUL', V. Ye.

64-1-2/19

AUTHORS: Dogadkin, B. A. , Gul', V. Ye. , Epshteyn, V. G.

TITLE: The Influence of Swelling on the Production of Heat and the Fatigue Resistance of Vulcanized Rubber (Vliyaniye nabukhaniya na teploobrazovaniye i soprotivleniye utomleniyu vulkanizatsiy)

PERIODICAL: Khimicheskaya Promyshlennost', 1958, Nr 1, pp. 5 - 11 (USSR)

ABSTRACT: In order to carry out investigations corresponding to the repeated deformation stresses of rubber tires and similar effects the influences on the reduction of the production of heat are investigated as well as the increase of the destruction resistance in repeated deformation processes. The latter can be expressed in time units (stability) or by the number of cycles. A demonstration model as well as the computation formula appertaining to it was developed by A. P. Aleksandrov for the better evaluation of the mechanical properties of vulcanizates. The penetration of a solvent into a polymer is bound to cause an energy change of the inter- and intramolecular forces, i. e. they also influence the

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The Influence of Swelling on the Production of Heat and the Fatigue Resistance of Vulcanized Rubber

production of heat in deformation stresses as well as the fatigue resistance. Swell experiments on a polymer based upon smoked sheets were carried out and it was found that a swelling in paraffin oil leads to a reduction of the production of deformation heat. Measurements of the coefficient of the mechanical losses in connection with the increase of the swelling degree were carried out by an apparatus according to Kornfel'd (reference 9). In experiments which were carried out by swelling of filled and unfilled natural rubber vulcanizates with paraffin oil and dibutylphthalate in a tester according to V. E. Gul' (references 7, 10) it was found that the fatigue resistance varies irregularly with the swelling degree. A decrease of the stability of the vulcanizate is observed in the case of more intensive swelling. The greater influence of dibutylphthalate (greater than that of Vaseline oil) is explained by the presence of polar and nonpolar domains. The necessity of the addition of a plasticizer to vulcanizates is determined in connection with the obtained investigation results. Investigations were carried out on the influence of mineral oil on the rubber properties

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The Influence of Swelling on the Production of Heat and the Fatigue Resistance of Vulcanized Rubber 64-1-2/19

in connection with the widely spread, of lately, "oil rubber" (a mixture of butydiene styrene rubber and mineral oils). Among other facts it was found that the addition of greater quantities of oil increases the fatigue resistance at normal and at increased temperatures. There are 11 figures, 3 tables, and 18 references, 16 of which are Slavic.

AVAILABLE: Library of Congress

1. Vulcanizates-Physical properties
2. Vulcanizates-Fatigue-Analysis
3. Vulcanizates-Temperature factors  
Test results
4. Vulcanizates-Deformation-

Card 3/3

AUTHORS:

Gul', V. Ye., Vil'nits, S. A.

SOV/156-58-2-41/48

TITLE:

Temperature Influence on the Kinetics of Growth of the Cutting of Vulcanizate (Vliyaniye temperatury na kinetiku razrastaniya nadreza v vulkanizate)

PERIODICAL:

Nauchnyye doklady vysshey shkoly. Khimiya i khimicheskaya tekhnologiya, 1958, Nr 2, pp. 365-368 (USSR)

ABSTRACT:

Several new papers (Refs 1- 4) give evidence of the fact that the rupture of the vulcanizate represents a process which continues to develop in the course of time. A slow and a rapid stage of rupture is distinguished. (Ref 1). It was shown by slow-motion pictures that the velocity of tearing is first very small but later it increases jump-like. This can be observed with as well as without a cutting. The influence of cutting was investigated in detail (Ref 5). The tearing of a vulcanizate has much in common with the tearing of brittle materials (L.N. Tsarskiy and G.Z. Krasikova participated in the experiment). Nevertheless the difference between the mechanism of a highly elastic and a brittle

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of the Cutting of Vulcanizate

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tearing is so considerable that important changes of the time course of its growth within the range of the passing from the highly elastic to the vitrified state could be expected. This was the purpose of the present investigation. Filled vulcanizates served for the experiment: mixture Nr 1: rubber SKB and Nr 2: SKB with natural rubber at a ratio of 4 : 6, mixture Nr 1 contained 45%, Nr 2 - 10% of soot. The vulcanizates could be tested at temperatures of up to  $-57^{\circ}$ . The projection of the slow-motion pictures made possible a retardation by 10 to 500 times. It can be seen from the elaboration of the motion pictures on the analyzer that at all temperatures the shape of the curves described already earlier could be observed (Ref 5). The initial velocity of tearing is so small that it cannot be investigated by means of the slow-motion picture method. Immediately before the end of tearing its velocity increases jump-like. In the case of the same conditions the maximum velocity is determined by the temperature of examination. At a lowering of temperature

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from 22 to 0° the velocity decreases from 2500 to 1000 mm/sec. The latter continues to decrease and then increases again at -50° and lower: it then reaches values of approximately 3000 mm/sec. Figure 1 shows the dependence concerned. Velocity does not change regularly. Apparently this change of the time course is in connection with the passing from a highly elastic tearing to a brittle one. The passing from a highly elastic state into a vitrified one is accompanied by a decrease of velocity of the formation of cracks and other phenomena. Their consideration is of great importance for the solution of practical problems which are connected with the mechanical destruction of vulcanizates. There are 2 figures and 9 references, 8 of which are Soviet.

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Temperature Influence on the Kinetics of Growth  
of the Cutting of Vulcanizate

SOV/156-58-2-41/48

ASSOCIATION: Kafedra fiziki Moskovskogo instituta tonkoy khimicheskoy  
tekhnologii im. M. V. Lomonosova (Chair of Physics of the  
Moscow Institute for Fine Chemical Technology imeni M.V.  
Lomonosov Moscow)

SUBMITTED: October 29, 1957

Card 4/4

5(1, 3)

AUTHORS:

SOV/153-58-5-19/28  
Gul', V. Ye., Faynberg, R. Ya., Mayzel's, M. G.,  
Rayevskiy, V. G., Sin'kova, M. I.

TITLE:

I. Physico-Chemical Characteristics of the Wetting Process of  
Textile Materials With Solutions of High-Molecular Compounds  
(I. Fiziko-khimicheskiye kharakteristiki protsessov smachi-  
vaniya tekstil'nykh materialov rastvorami vysokomolekulyarnykh  
soyedineniy)

PERIODICAL:

Izvestiya vysshikh uchebnykh zavedeniy. Khimiya i khimicheskaya  
tekhnologiya, 1958, Nr 5, pp 114-119. (USSR)

ABSTRACT:

The mechanism of the interactions of the processes mentioned  
in the title is of scientific and practical interest. The  
application of rubber glues on a textile basis in the production  
of gummed tissues can serve as example. As the wetting re-  
presents the first elementary interaction process therein, it  
can exert essential influence on the characteristics of adhesion.  
The dependence of the wetting upon the nature and the structure  
of the glues and the textile materials must therefore be studied.  
Apparently the value  $\theta$  cannot supply any clear characteristic  
feature of the adhesion to textiles in the case of glue (just  
as with latex, Refs 1, 2). On the other hand, the authors re-

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NOV/153-58-5-19/28

I. Physico-Chemical Characteristics of the Wetting Process of Textile Materials With Solutions of High-Molecular Compounds

garded it as possible to determine such a characteristic feature by studying the variation kinetics of the angle  $\theta$  with respect to time. For this purpose they selected the method of the indirect measurement of the external angle  $\theta$  of the wetting on an enlarged picture of the drop projected unto a screen. It could be proved that 1) the variation character of the curves of the said angle reflects the totality of the processes taking place during the interaction of the glue with the cloth, these processes are the soaking and the evaporation in a room saturated with evaporated solvents (Figs 1, 4) besides these processes in an unsaturated room (Figs 3, 5); 2) It was proved that the residual values of  $\theta$  increase with the viscosity of the glue, whereas the total velocity of the processes, soaking and deliquescence, decrease. 3) The kinetic parameter  $\tau_{\max}$  was determined; it is the period of time within which the drop has reached a stable state. This parameter is a criterion of the degree of susceptibility of various textiles to rubber glue (cotton - perkai' B, caprone art. 1516 and 1520, glass cloth

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I. Physico-Chemical Characteristics of the Wetting Process of Textile Materials With Solutions of High-Molecular Compounds

ESTBO 11) 4) In spite of the decrease in viscosity  $\eta$  and of the surface tension  $\sigma$  the addition of polar admixtures slows down the decrease of the external angle with time and increases the value of  $\tau_{\max}$ . 5) The adhesion characteristics of the glue-tissue systems investigated were determined. They are in good correlation with the wetting parameters  $\theta$  and  $\tau_{\max}$ . 6) It was found possible to predetermine the interaction character of the glue with the textile base as well as the binding strength of these elements in finished constructions of gummed cloths by means of the degree and the variation character of the parameters  $\theta$  and  $\tau_{\max}$ . There are 8 figures, 3 tables, and 6 Soviet references.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii i nauchno issledovatel'skiy institut rezinovoy promyshlennosti (Moscow Institute for Fine Chemical Technology and Scientific Research Institute for Rubber Industry)

SUBMITTED: December 2, 1957  
Card 3/3

SOV/138-58-9-5/11

**AUTHORS:** Gul', V. Ye; Fedynkin, D. L; Degudkin, B. A.

**TITLE:** The Effect of Changing the Intermolecular Interaction on the Dynamic Fatigue of Rubbers (Vliyaniye izmeneniya mezhmolekulyarnogo vzaimodeystviya na dinamicheskuyu ustalost' rezin)

**PERIODICAL:** Kauchuk i Rezina, 1958, Nr 9, pp 16 - 20 (USSR)

**ABSTRACT:** The physical and mechanical properties of vulcanisates depend to a considerable degree on the rate of the intermolecular interaction. Therefore, a change in the character and rate of the interaction will cause a corresponding alteration in the mechanical properties of the vulcanisates. Deformation is accompanied by disruption of localised intermolecular bonds. A certain amount of heat is, therefore, created during the deformation process (Ref.9 and 10). The disruption of secondary links causes hysteresis, relaxation and formation of heat. This formed heat intensifies the chemical reactions occurring in the vulcanisates. A change in the structure can be observed during periodic deformation. These changes depend on its conditions and on the chemical reactions such as oxidation, polymerisation, etc. Tests were carried out on natural

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The Effect of Changing the Intermolecular Interaction on the Dynamic  
Fatigue of Rubbers

butadiene-styrene (ratio of the butadiene/styrene equalled 70:30), butadiene-nitrile (ratio of butadiene/acrylonitrile equalled 60:40; 74:26 and 82:18). Dimethylphthalate (DMF), dibutylphthalate (DBF), dioctylphthalate (DOF), dibutylsebacate (DBS), dioctylsebacate (DOS) and vaseline oil (BM) were used as solvents for the vulcanisates. The vulcanisates were subjected to swelling, the degree of which is expressed in percentage. The fatigue resistance was investigated under conditions of constant final amplitudes of deformation (Ref.2 and Fig.1). Tests were carried out at room temperature and a frequency of 254 cycles/minute. A typical strength/deformation curve for a filled vulcanisate based on SKN-40 is given in Fig.2. These experiments were carried out on the machine Metalist MRS-2. Figs.3 - 5: changes in the fatigue resistance of filled vulcanisates of natural rubber, SKS-30 and SKN-40 when using the various solvents. A decreasing rate of the intermolecular interaction during

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The Effect of Changing the Intermolecular Interaction on the Dynamic Fatigue of Rubbers

swelling is proved by the changes in the coefficient of mechanical losses during swelling and at the glass temperature (Fig.6). These experiments prove that the changes in the residual resistance of vulcanisates during swelling in low-molecular solvents depend not only on the degree of swelling, but also on the characteristics of the solvent and the rubber. Changes in the fatigue resistance of non-filled SKN vulcanisates, depending on the concentration of acrylonitrile, are given in Fig.7; the dependence of the fatigue resistance of filled SKS-30 vulcanisates on the quantity of DMF-1, DOP-2x, VM-3 and DOS-4: Fig.8. When carrying out tests on thin samples, the temperature of the sample itself does practically not depend on the molecular interaction, and is approximately the same as the temperature of the surrounding medium. It can be assumed that solvents causing the sharpest decrease in the fatigue resistance during swelling of small articles should be responsible for the greatest increase of the fatigue resistance in larger samples. From results shown in Figs. 8 and 9a it can be seen that the fatigue resistance falls pro-

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The Effect of Changing the Intermolecular Interaction on the Dynamic  
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portionately with increase in the dosage of the plasticiser. The optimum composition of mixtures of the material can be defined by investigating the physical action of plasticisers and analysing their effect on the swelling of the vulcanisates. In this way the more important properties of vulcanisates, such as fatigue resistance, mechanical losses and frost resistance, can be improved by using solvents (plasticisers) containing characteristic functional groups. There are 10 Figures and 13 References: 11 Soviet and 2 English.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii im. M. V. Lomonosova (The Moscow Institute for Fine Chemical Technology im. M. V. Lomonosov)

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SOV/138-58-10-6/10

**AUTHORS:** Gul', V.Ye.; Vil'nits, S. A; Gel'perin, N. I; Il'in, N.S;  
Kaplunov, Ya. N; Tsarskiy, L. N. and Krasikova, G. 2.

**TITLE:** Investigation of the Possibility of Pulverizing Chilled Rubber (Razrabotka sposoba izmel'cheniya okhlazhdennykh rezin)

**PERIODICAL:** Kauchuk i Rezina, 1958, Nr 10, pp 22 - 28 (USSR)

**ABSTRACT:** Much rubber scrap is not re-used because of the difficulty of pulverizing the material. This difficulty can be overcome by chilling the rubber. The authors first review the changes in physical and mechanical properties of rubber at low temperature. Fig.1 shows maximum speed of rupture (mm/sec) against temperature for a vulcanized mixture of SKB and natural rubber. Fig.2 shows the same for SKB (Butyl) rubber. Each figure shows curves for three different rates of deformation. The maximum speed of rupture is that which occurs immediately before the specimen parts. The re-orientation of material at the point where rupture commences was studied by scribing a line across the specimens, and comparing the thickness of the line where rupture commences with the thickness of the line in the unruptured part of the stretched specimen. In Fig.4 these relative thicknesses are plot-

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# Investigation of the Possibility of Pulverizing Chilled Rubber

ted against time for specimens of SKB and natural rubber at four different temperatures. The specimens were deformed at a rate of 500 mm/min. At -53°C no re-orientation at the rupture point occurs. Fig.5 shows stress versus relative elongation for the same rubber mix at different temperatures. Fig.6a shows the relative elongation versus temperature, and Fig.6b the stress versus temperature at the moment of rupture, in each case for three different rates of deformation. In Fig.7 the work of deformation ( $\text{kg/cm}^3$ ) is plotted against temperature for SKB-50 and the same in Fig.8 for SKB-50 plus natural rubber. By comparing Figs. 2, 6 and 7 one sees that the temperature for maximum work of deformation to rupture corresponds to that for minimum speed of rupture and for maximum relative elongation at rupture. At low temperatures the low mobility of the molecular structure prevents re-orientation at the point of rupture as is seen in Fig.4; the resistance to rupture and relative elongation decrease and the speed of rupture increases. Fig.9 shows stress versus relative elongation for samples of rubber and fabric, cut from a tyre casing, at three different rates of deformation for four temperatures. These follow

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Investigation of the Possibility of Pulverizing Chilled Rubber

the same form as the plain rubber specimens in Fig.5.

In order to obtain a brittle state when pulverizing rubber and fabric materials the temperature must be lowered and the speed of pulverization or rupture must be increased. The apparatus shown in Fig.10 was constructed to determine optimum speed of deformation for pulverization. Specimens 10 - 20 mm wide and 1 - 6 mm thick are clamped to the periphery of a 200 mm disc which can be rotated at various speeds. The disc runs in an insulated tank. The specimens strike against a pin mounted on a spring, so that the force acting on the pin can be measured dynamometrically, and the energy of deformation in fracturing the specimens can be calculated. Optimum speed was found to be in the region of 3000 r.p.m. From the parameters established, the hammer-mill type of pulverizer, shown in Fig.11, was constructed. The gap between the hammers and the saw-toothed periphery of the mill casing is 1.5 - 2 mm. The mill runs at 3000 r.p.m. The mill is fed with pieces of rubber about 40 x 20 x 8 mm previously cooled in a dry ice and alcohol mixture. Pulverized material discharged through the grating at the

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## Investigation of the Possibility of Pulverizing Chilled Rubber

base of the mill was subjected to sieve analysis. Energy input was measured by a recording wattmeter. Table 1 shows results with this pulverizer for various rubber and rubber fabric materials. The size of the openings in the discharge grating was either 5 mm or 2 mm. Material was cooled to temperatures of  $-66^{\circ}$ ,  $-60^{\circ}$  and  $-50^{\circ}\text{C}$ . Time and k.w.h. to pulverize 400 gramme quantities of material are given, and the specific energy requirement in k.w.h. per metric ton of material is given in the last column. Table 2 gives the sieve analysis for the various samples for 5 mm and for 2 mm openings in the discharge grating. To complete the calculation for energy requirements, the power in k.w.h. required to cool one ton of material to temperatures between  $5^{\circ}\text{C}$  and  $-55^{\circ}\text{C}$  are given. These calculations are based on an initial temperature of  $20^{\circ}\text{C}$ ., specific heat of material  $0.5 \text{ c.cal/kg}^{\circ}\text{C}$ , and 59.5% cooling efficiency from a Freon 12-refrigeration circuit as

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Investigation of the Possibility of Pulverizing Chilled Rubber.

in Fig.12 with a further 20% loss to air allowed for.  
There are 12 Figures, 2 Tables and 7 Soviet References

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii  
im. M. V. Lomonosova (Moscow Institute of Precision  
Chemical Technology imeni M.V. Lomonosov)

Card 5/5



69-20-3-1/24

AUTHORS: Lipatov, S.M.; Voyutskiy, S.S.; Gul', V.Ye.

TITLE: On the 60th Anniversary of Boris Aristarkhovich Dogadkin (K shestidesyatiletuyu so dnya rozhdeniya borisa Aristarkhovicha Dogadkina)

PERIODICAL: Kolloidnyy zhurnal, 1958, vol XX, Nr 3, pp 257-259 (USSR)

ABSTRACT: A short biography of Professor, Doctor of Chemical Sciences, Dogadkin is given. His scientific activity is concentrated in the field of natural and synthetic rubbers and the technology of resin. He initiated the emulsion polymerization in the USSR, and is the author of an industrial method of producing synthetic latex. Since 1940, he and his coworkers have been investigating the vulcanization process. He developed the thermomechanical method, the method of isotope exchange with S<sup>35</sup>, etc. He also investigated electric conductivity, dielectric properties, etc. and discovered the thixo-tropic chain structures in resins. He published 148 scientific works and 4 books, among them "Chemistry and Physics of Rubber". Since 1945, he has been Second Editor of Kolloidnyy zhurnal.

Card 1/1

**1. Biography**

69-29-5-16/24

AUTHORS: Gul', V.Ye.; Tsarskiy, L.N.; Vil'nits, S.A.

TITLE: The Process of Rupture in the Region of Transition From the Elastic to the Brittle State (Issledovaniye protsessa razryva v oblasti perekhoda ot elasticheskogo k khrupkomu sostoyaniyu)

PERIODICAL: Kolloidnyy zhurnal, 1958, vol XX, Nr 3, pp 318-325 (USSR)

ABSTRACT: The rupture of vulcanizates is a process lasting a certain time. In the article, experiments are mentioned in which this process has been studied by means of high-speed cinematography. More than 300 moving pictures were taken. The analysis of the pictures has shown that the speed of rupture in the temperature range from +22 to -57°C is very small in the initial stages and increases rapidly immediately before the complete rupture. At a temperature decrease from +22 to 0° the rupture speed decreases from 2,500 mm/sec to 100 mm/sec. This is due to an increase in the bonds of intermolecular interaction. At temperatures of -50°C and lower the rupture speed attains a value of 3,000 mm/sec. The temperature decrease is also accompanied by a decrease of the additional orientation of the material. At very low

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69-20-3-10/24

The Process of Rupture in the Region of Transition From the Elastic to the Brittle State

temperatures, the reduction of additional orientation becomes so large that the speed of rupture increases again. A correlation exists not only between the temperature and the speed of rupture, but also between temperature and mechanical properties of the rubber. At the transition from the high-elastic to the brittle rupture mechanism, an abnormal change in the resistance to rupture is observed, together with a change in temperature. In the temperature regions characterized by the elastic and brittle rupture mechanisms, an increase in the stability of the material is observed. At the transition from the elastic to the brittle rupture, the stability of the material is reduced as a consequence of changes in the structural characteristics of the material. There are 11 graphs and 8 references, 7 of which are Soviet and 1 German.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii, Moskva  
(Moscow Institute of Fine Chemical Technology, Moscow)

SUBMITTED: May 3, 1957  
Card 2/2

1. Vulcanizates—Transition    2. Vulcanizates—Rupture

69-20-3-23/24

AUTHORS: Dogadkin, B.A.; Gul', V.Ye.; Morozova, N.A.

TITLE: The Effect of Electric Charges Formed During Repeated Deformations on the Fatigue Resistance of Vulcanizates (O vliyani elektricheskikh zaryadov, voznikayushchikh v protsesse mnogokratnykh deformatsiy, na soprotivleniye utomleniyu vulkanizatov)

PERIODICAL: Kolloidnyy zhurnal, 1958, vol XX, Nr 3, pp 397-398 (USSR)

ABSTRACT: Electroelastic and friction-elastic effects cause electrical charges on deformed polymer products. The influence of these charges on the fatigue resistance of the vulcanizates has been studied in the article. Samples containing from 0-22 weight parts of carbon black did not conduct the electrical current of 127 v. A sample with 30 weight parts of carbon black broke after 215,000 test cycles, if the charges remained on it. If the charges were led off, the sample showed no change which could have been detected visually after 315,000 test cycles. The relative figures for 40 weight parts of carbon black are 23,000 cycles and 48,000 cycles; for 75 weight parts 8,000 and 20,000. The removal of the electrical charges, formed

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69-20-3-23/24

The Effect of Electric Charges Formed During Repeated Deformations of the Fatigue Resistance of Vulcanizates

during deformation of the polymer products, increases the fatigue resistance two times.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii (Moscow Institute of Fine Chemical Technology)

SUBMITTED: March 28, 1958

Card 2/2      1. Vulcanizates--Fatigue      2. Polymers--Deformation      3. Vulcanizates  
--Conductivity

5(4)

SOV/20-123-4-39/53

AUTHORS: Gul', V. Ye., Chernin, I. M.

TITLE: The Experimental Investigation of the Distribution of **Stresses** in the Process of the Rupture of Polymers (Eksperimental'noye issledovaniye raspredeleniya napryazheniy v protsesse razryva polimerov)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 123, Nr 4, pp 713-715 (USSR)

ABSTRACT: The authors developed a method of taking slow-motion pictures with polarized light for the purpose of determining data concerning the distribution and variation of **stresses** during the increase of the range of rupture. Polyethylene, polymethyl metacrylate and vulcanized rubber were used as test objects. The light source used was a 3000 watt headlight or a direct current light arc. The samples were deformed up to rupture by means of the machine RMM (which was specially adapted ~~for~~ these tests). 2 herapathite polaroids were used as polarizer and also as analyzer. The lines connecting points with equal coloring make it possible to form an opinion concerning the normal **stresses** in the cross section of the **sample**.

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The abovementioned polymers have essentially different

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The Experimental Investigation of the Distribution of ~~Stresses~~ in the Process of the Rupture of Polymers

mechanisms of rupture. Individual pictures selected from the slow-motion pictures taken of polyethylene ruptures in polarized light are attached. In the final stages of rupture there are no overtensions at the place where the range of rupture increases. At the beginning of deformation the tensions in the sample are distributed in a markedly homogeneous manner. At the place of incision ~~overstresses~~ peaks occur, which, however, become flatter with further elongation. In linearly crystallizing polymers of the polyethylene type the surface of fracture is rapidly elongated in the homogeneous zone of ~~stresses~~. In polymers with a developed spatial structure of the type of vulcanization products obtained from films of natural latex, ~~stresses~~ are distributed in the planes located along the axis of elongation. Rupture occurs ~~along~~ these surfaces as soon as ~~overstresses~~ attain sufficiently high values. The authors thank V. A. Kargin, Academician, for his very valuable advice and B. M. Kovarskaya for placing the samples at their disposal. There are 4 figures.

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SOV/138-59-2-6/24

AUTHORS: Gul', B. Ye., Dogadkin, B. A. and Van Man'-sya

TITLE: Investigation of the Effect of Fillers on the Distribution of Deformation in a Vulcanisate Sample Subjected to Rupture Tests (Issledovaniye vliyaniya napolniteley na raspredeleniye deformatsiy v razryvayushchemsya obraztse vulkanizata)

PERIODICAL: Kauchuk i rezina, 1959, Nr 2, pp 17-20 (USSR)

ABSTRACT: The Elastomer Laboratory of MITKhT imeni M.V.Lomonosov developed recently a high-speed photographic method, used during rupture tests for vulcanisates (Refs 4-6) which makes possible a direct observation of the distribution of deformations in filled and unfilled vulcanisates. The effect of active and inactive carbon blacks on deformation properties of vulcanisates during rupture processes was investigated. Vulcanisates of non-crystallising sodium butadiene rubber were tested, the composition of which is given. A large number of high-speed photographs were taken of vulcanisates which contained different quantities of carbon blacks. The rate of rupture was found to be small at first but

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SOV/138-59-2-6/24

Investigation of the Effect of Fillers on the Distribution of Deformation in a Vulcanisate Sample Subjected to Rupture Tests

increased in stages up to the breaking point. Average rates of rupture were calculated and the dependence of these on the concentration of carbon black in the vulcanisate is given (Fig 1). It can be seen that different curves were obtained for channel black and for various types of carbon black. Filled vulcanisates show an unequal distribution of deformation in the sample (Ref 6). During equal stretching additional elongation of a sample was observed in the place of rupture. This deformation should be accompanied by an orientation of the material in the place of rupture and the authors determined the degree of this orientation (Fig 2). The influence of the degree of filling, also of the filler itself, on the deformation curves was investigated (Fig 3). The rupture of vulcanisates is characterized by an increase in the time of rupture when increasing the concentration of channel black up to 40 parts weight to 100 parts weight of rubber (Fig 4). A further addition of channel black causes a decrease in the time of

Card 2/4 rupture. Figs 5 and 6 show the physico-mechanical

SOV, 138-59-2-6/24

Investigation of the Effect of Fillers on the Distribution of  
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properties of vulcanisates as a function of filling with channel and thermal black. The modulus of elasticity of the vulcanisates increases uniformly with increasing concentration of carbon black. Unfilled vulcanisates show an unequal distribution of tension. This applies also to filled vulcanisates but in these the distribution of tension is slightly more equal. The maximum values of additional orientation in the place of rupture are relatively small for unfilled vulcanisates as well as for those containing carbon black. It is suggested that the interaction between the carbon black particles and the molecules of rubber in the vulcanisates is small; this is confirmed by the small losses in hysteresis. The relaxation properties of vulcanisates are more satisfactory when active channel black is used as filler. This is explained by an increase in the tension which exists up to the point of rupture. Microphotographs were taken with the aid of a micro-film unit MKU-1. The samples were subjected to deformation up to

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Investigation of the Effect of Fillers on the Distribution of  
Deformation in a Vulcanisate Sample Subjected to Rupture Tests

800% elongation. Fig 7 shows the dependence of the degree of additional micro-orientation on the duration of deformation of the filled vulcanisate. It is concluded that a minimum average rate of rupture occurs when channel black is used as filler. The formation of carbon black structure in the rubber is closely connected with the degree of additional orientation of the material in the place of rupture. Investigations on the increase of additional orientation during the rupture process in filled vulcanisate confirmed the conclusions which were based on the analysis of high-speed photographs taken during the rupture of filled vulcanisates. There are 7 figures and 7 Soviet references.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii  
im. M. V. Lomonosova (Moscow Institute for Fine Chemical  
Technology imeni M. V. Lomonosov)

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5 (1, 3)

AUTHOR: Gul', V. Ye.

SOV/153-2-1-20/25

TITLE: On the Problem of the Influence Exerted by Molecular Interaction Upon the Strength of Vulcanizates (K voprosu o vliyanií mezhmolekulyarnogo vzaimodeystviya na prochnost' vulkanizatorov)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Khimiya i khimicheskaya tekhnologiya, 1959, Vol 2, Nr 1, pp 109-113 (USSR)

ABSTRACT: When studying high polymers with well developed spatial structure it is necessary to consider the afore-mentioned influence in connection with the temperature dependence of mechanical properties. The present theories of highly elastic deformation permit the evaluation of the influence exerted by the afore-mentioned interaction and temperature upon characteristic mechanical data such as elasticity module, temperature range of high elasticity as well as the rate of mechanical relaxation. For the purpose of studying the above-mentioned problem the author employed model vulcanizates with different degree of cross-linkage, which differed, however, by the values of specific cohesion energy. This was attained by changing the concentration of the polar atomic

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On the Problem of the Influence Exerted by Molecular Interaction Upon the Strength of Vulcanizates SOV/153-2-1-20/25

groups in the chain molecule or by the degree of expansion (Ref 1). This article is based on earlier publications (Refs 2-6) dealing with the tensile strength and the state of fatigue of "elastomers". In order to obtain the ordinary characteristics by way of the extension of a microcrack, it is necessary to explain the connection between the rate of expansion of the crack and the rate of deformation of the sample as a whole. The first-mentioned rate was determined (in cooperation with G. P. Krutetskaya and V. V. Kovriga) in the case of butadiene-nitrile-rubber samples at various rates of deformation by means of high-speed photography (350-8000 pictures/sec). The variation on this rate with time was determined accordingly. In logarithmic coordinates there is a linear connection between rate and time. Thus, it was possible to replace the rate of extension by the rate of deformation. In this manner characteristics were obtained which are determined in ordinary tests. For the purpose of reducing the effect of temperature resulting during fatigue, the author employed thin samples (this part of the investigation was dealt with together with V. G. Dreval').

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The intermolecular interaction was diminished by expansion in dibutyl phthalate, dimethyl phthalate, and dioctyl sebacinate. Figures 3 a, b illustrate the dependence of  $\lg \gamma$  on  $\lg P$  (logarithm of tension). It follows from the measurements that the duration of resistance to fatigue increases with rising intensity of intermolecular interaction and decreases with rising temperature. The dependence on the maximum tension is similar to that of static fatigue. D. M. Sandomirskiy and I. M. Kochur assisted in this investigation. The influence of intermolecular interaction differs fundamentally from that fatigue in which physical factors prevail by the predominance of chemical processes in its fatigue (increase in the specific cohesion energies due to higher mechanical losses and intensification of destructive chemical processes). The resultant connection opens new ways for improving the quality of rubber products. There are 4 figures and 8 Soviet references.

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On the Problem of the Influence Exerted by Molecular      SOV/153-2-1-20/25  
Interaction Upon the Strength of Vulcanizates

ASSOCIATION:    Moskovskiy institut tonkoy khimicheskoy tekhnologii imeni  
                  M. V. Lomonosova; Kafedra fiziki i khimii knuchuka (Moscow  
                  Institute of Fine Chemical Technology imeni M. V.  
                  Lomonosov; Chair of Rubber Physics and Chemistry)

SUBMITTED:      November 10, 1957

Card 4/4

5(1,3)

AUTHORS:

Gul', V. Ye., Faynberg, R. Ya.,  
Mayzel's, M. G., Rayevskiy, V. G.

SOV/153-2-2-24/31

TITLE:

Physico-chemical Characteristics of the Interaction Processes of Polymer Materials With Solutions of High-molecular Compounds (Fiziko-khimicheskiye kharakteristiki protsessov vzaimodeystviya polimernykh materialov s rastvorami vysokomolekulyarnykh soyedineniy). II. On the Effect of the Nature of Textile Materials on Their Interaction With Rubber Glues (II. Vliyaniye prirody tekstil'nykh materialov na ikh vzaimodeystviye s rezinovymi kleyami)

PERIODICAL:

Izvestiya vysshikh uchebnykh zavedeniy. Khimiya i khimicheskaya tekhnologiya, 1959, Vol 2, Nr 2, pp 270-273 (USSR)

ABSTRACT:

The application of a rubber-glue-coating on a textile layer, during the production of rubber-impregnated textiles, forms a practical example for the interaction mentioned in the title. The total impression of the kinetic curves which characterize the change of the boundary-angle  $\theta$  with the time, reflects the totality of the processes between the rubber-glue (- latex dissolved in petrol), which occur between this glue, and the textile base (Ref 1). The

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Physico-chemical Characteristics of the Interaction SOV/153-2-2-24/31  
Processes of Polymer Materials With Solutions of High-molecular Compounds.  
II. On the Effect of the Nature of Textile Materials on Their Interaction  
With Rubber Glues

character of this interaction can be predicted, and the relative strength of their bonding can further be estimated from the degree and character of the change of the kinetic parameters  $\theta$  and  $\tau_{\max}$ . In spite of the slight adhesion of several types of artificial fibres (polyamide-, glass-, viscose-fibres) in relation to the rubber coatings, the use of textile fibres on this base is often very appropriate. Their advantages are among others: high mechanical indices, resistance against aging, good rot-preventing properties. Apparently it is possible, by combining fibres of varying chemical nature, to produce textiles which have the required complex of technical properties. The following combined textiles were investigated: a) glass-cotton, b) glass-kapron, and c) glass-viscose fibre. The following compositions served as a glue: (parts by weight) rubber 100, sulphur 4, magnesium-oxide 5, neozone D 1 part. The wetting processes were estimated by direct measurement of the boundary angle on an

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Physico-chemical Characteristics of the Interaction SOV/153-2-2-24/31  
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enlarged photography of the drop (Ref 1). The  $\tau_{\max}$  values were determined on stationary sectors of the transformation curves of the wetting angle in connection with the time. On the basis of the results, the authors arrive at the following conclusions: 1) By building-up textile materials from fibres of various chemical nature, it is possible to alter the wetting-characteristics through rubber-glues in a required direction. 2) The introduction of cotton-fibres in textiles of synthetic or artificial fibres (glass-, polyamide-, viscose-, and other fibres) enables improving their wetting-property considerably (Figs 1-3). 3) The investigated textiles are placed in the following order, according to the reaction-intensity with rubber glues, as well as to the  $\tau_{\max}$  values: glass-cotton > glass-kapron > glass-viscose. For the  $\tau_{\max}$  value, this order is valid for all viscosity values. 4) For combined textiles or those which consist of a single type of fibre, the impregnation-spilling processes develop

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Physico-chemical Characteristics of the Interaction SOV/153-2-2-24/31  
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more intensively in a space saturated by the solvent. 5) The viscosity-increase of the glue slows down the processes mentioned under Nr 4. 6) The higher the glue-viscosity, the higher the range of the values of the wetting angle of the respective materials. 7) The  $\tau_{\max}$  value (the time interval within which the system textile-glue attains a quasi-equilibrium state) is determined by the nature of the fibre of the combined textile. There are 3 figures, 1 table, and 1 Soviet reference.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii i Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti (Moscow Institute of Fine Chemical Technology and Scientific Research Institute of the Rubber Industry)

SUBMITTED: March 15, 1958

Card 4/4

5(1,3)

AUTHORS:

Gul', V. Ye., Mayzel', N. S., SOV/153-2-2-25/31  
Frenkel', S. N., Il'in, N. S., Kaplunov, Ya. M., Khmunin,  
S. F., Voronkov, Yu. F.

TITLE:

Examination of the Use of High-molecular Substances for  
the Isolation of Current Conducting Rails (Issledovaniye  
primeneniya vysokomolekulyarnykh veshchestv dlya izolyat-  
sii shin tokoprovodov)

PERIODICAL:

Izvestiya vysshikh uchebnykh zavedeniy. Khimiya i khimiches-  
kaya tekhnologiya, 1959, Vol 2, Nr 2, pp 274-279 (USSR)

ABSTRACT:

A number of demands is made on the isolation mentioned in  
the title, which could not be satisfied for a long time. In  
most cases a material perfect in every way proved to be  
unsatisfactory with regard to one single characteristic, so  
that the rails mentioned in the title could not be isolated.  
A uniform point-of-view concerning the electric break-down  
of high-molecular compounds is lacking at present. The  
authors presume that the electric field strength at which a  
high-molecular compound breaks down, is mainly determined  
by peculiarities of the chemical structure of the macro-  
molecules, further by the structure of the material

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Examination of the Use of High-molecular Substances  
for the Isolation of Current Conducting Rails

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based upon a high-molecular compound, as well as by a number of external factors which are connected with the application of the relevant products. By confronting the values of a total polarization (electronic, ionic, and structural), it is possible to estimate the suitability of a material with a certain chemical composition. The structural polarization, first established by P. P. Kobeko, is characteristic of caoutchouc and caoutchouc-like materials. The purpose of the present paper is an attempt to use high-molecular materials of such composition and mode of application which meet all demands for isolating the rail surface. Butyl-caoutchouc, butadiene-styrene-caoutchouc, silicon-caoutchouc, polyamide-resin 548, polyvinyl-butyral, polytetrafluoro-ethylene (fluoroplast), and polyethylene were used. A device was set up for testing the resistance to electric breakdown. All requirements of GOST-864-41 were satisfied during the tests. Only the test voltage was increased to 3,500-5,000 v instead of 2,000 v. First of all the methods of application of the isolation-coating to the sample

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Examination of the Use of High-molecular Substances  
for the Isolation of Current Conducting Rails

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were discussed. All types of coatings were tested for heat-, frost-, light-, and ozone-resistance, and for vibration. Tables 1 and 2 show that the isolation on the basis of polymer substances, applied in molten state on a heated metal surface, differs from other isolation methods with polymers of increased electric strength. The authors propose a rational method of isolation for the conductor-rail, that is the application of molten and sprayed polyethylene particles on a heated rail surface. There are 2 tables.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii imeni M. V. Lomonosova; Kafedra fiziki (Moscow Institute for Fine Chemical Technology imeni M. V. Lomonosov; Chair of Physics)

SUBMITTED: December 16, 1957

Card 3/3

GUL', ~~M~~ Ye.; DOGADKIN, B.A.; VAN MAN'-SYA [Wang Man-hsia]

Investigating the effect of fillers on the distribution of stresses in tearing a test piece of vulcanizate. Kauch. i rez. 18 no.2:17-20 F '59. (MIRA 12:4)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii imeni M.V. Lomonosova.

(Rubber--Testing)

5(4)

SOV/69-21-3-6/25

AUTHORS: Gul', V. Ye. and Lushcheykin, Yu.G.

TITLE: The Effect of Molecular Interaction on the Electric Strength of Vulcanizates

PERIODICAL: Kolloidnyy zhurnal, 1959, Vol XXI, Nr 3, pp 283-288 (USSR)

ABSTRACT: The authors report on an investigation intended to ascertain the dependence of the electric strength of pure vulcanizates on the intensity of molecular interaction (the magnitude of specific cohesional energy). For the experiments samples  $0.1 \div 0.4$  mm thick were used, in order to reduce the heterogeneity of the field. The experiments were carried out so as to ensure an electric breakdown, a procedure utterly suitable to set forth the effect of the nature of the polymer. The experiments proved the statistical character of the electric strength (which has much in common with mechanical strength): the character of the distribution curves, the dependency of

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The Effect of Molecular Interaction on the Electric Strength of  
Vulcanizates

electrical and mechanical strength on the thickness of the sample and its temperature. In the field of high elastic states molecular interaction does not exercise a remarkable influence on electric strength. In the field of transition from a high-elastic to a vitrified state, however, the factors which determine the mobility of the links of chain molecules, exercise a considerable effect on electric strength. The experiments further proved that the maximum value of electric strength is directly proportional to the specific cohesional energy, provided that the remaining characteristics of the chemical character of the polymer remain unchanged. With the lowering of temperature, the electric strength of vulcanizates increases, reaching a maximum at the temperature of vitrification. It decreases, however, at a further lowering of the temperature. The authors ascertained a linear dependency between maximum electric strength and vitrification temperature for rubbers of similar chemical

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The Effect of Molecular Interaction on the Electric Strength of Vulcanizates

structure. In the field of transition from the high-elastic to the vitrified state electric and mechanical strength are characterized by analogous dependencies on different factors (measures of the sample, temperature, period of activity of the mechanical or electrical field, specific cohesive energy of the high-polymers). The authors mention the Soviet scientist G.M. Bartenev [Ref 11]. There are 3 graphs, 2 diagrams and 13 references, 12 of which are Soviet and 1 English.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii im. M.V. Lomonosova (Moscow Institute of Fine Chemical Technology imeni M.V. Lomonosov)

SUBMITTED: 26 December, 1957

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PHASE I BOOK EXPLOITATION

SOV/5064

Gul', Valentin Yevgen'yevich, Professor, Doctor of Chemical Sciences, and  
Nikolay Prokof'yevich Fedorenko, Professor, Doctor of Economics

Polimery; vysokomolekulyarnyye veshchestva. Posobiye dlya uchiteley (Polymers;  
Macromolecular Substances. Textbook for Teachers) Moscow, Uchpedgiz, 1960.  
178 p. Errata slip inserted. 21,000 copies printed.

Ed.: A. A. Korotkiy; Tech. Ed.: T. V. Karpova.

PURPOSE: This textbook is intended for chemistry teachers in secondary schools  
and for students in pedagogical institutes.

COVERAGE: The textbook describes the basic problems connected with the chemical  
and technological principles of high polymers. It presents data on the raw  
materials and on the economics of manufacturing caoutchouc, rubber, plastics,  
and synthetic fibers. The material is based on Soviet and other textbooks,  
monographs, scientific journals, and on previous works of the authors. The  
authors thank Professor Z. A. Rogovin, Doctor of Chemical Sciences;

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Polymers; Macromolecular Substances (Cont.)

SOV/5064

N. S. Prostakov, Docent, Candidate of Chemical Sciences; N. S. Il'in, Docent, Candidate of Chemical Sciences; Ya. N. Kaplunov, Docent, Candidate of Technical Sciences; V. A. Lepetov, Docent, Candidate of Technical Sciences; L. A. Tsvetkov, Senior Scientific Workers of the APN RSFSR, and B. A. Krentsel', Doctor of Chemical Sciences. There are no references.

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Polymers; Macromolecular Substances (Cont.)

SOV/5064

Ch. IV. Caoutchouc

73

Ch. V. Rubber

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Ch. VI. Plastics

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Ch. VII. Chemical Fibers

151

AVAILABLE: Library of Congress

JA/dwm/kb  
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83812

S/190/60/002/005/002/015

B004/B067

15.1124 also 2209

11.2211

AUTHORS: Vakula, V. L., Khe Yun'-tszuy, Gul', V. Ye., Voyutskiy,  
S. S.

TITLE: Adhesion of Polymers. VI. <sup>11</sup> Effect of the Molecular Weight  
of Butadiene Acrylonitrile Copolymers of Different Polari-  
ty on Adhesion to Polar and Apolar Substrate

PERIODICAL: <sup>15</sup> Vysokomolekulyarnyye soyedineniya, 1960, Vol. 2, No. 5,  
pp. 636-645 ✓

TEXT: The purpose of this paper was to study the influence exerted by the molecular weight at constant polarity, as well as the influence of polarity at constant molecular weight and the influence of temperature on adhesion. For this purpose, commercial butadiene acrylonitrile copolymers (rubbers) of the types CKH-18 (SKN-18), CKH-26 (SKN-26), and CKH-40 (SKN-40) were isolated from benzene solutions by means of methanol fractions. Table 1 gives the molecular weights and the acrylonitrile content of the fractions determined from the nitrogen content. The fractions were glued onto a polar polyamide (caprone film Perfol of the type PK-4 ✓) or onto apolar polybutylene (molecular weight 118,000) at room temperature.  
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83812

Adhesion of Polymers. VI. Effect of the  
Molecular Weight of Butadiene Acrylonitrile  
Copolymers of Different Polarity on Adhesion  
to Polar and Apolar Substrate

S/190/60/002/005/002/015  
B004/B067

temperature according to the method described in Ref. 8. Some samples were heated to 50 - 200°C for 30 min under load and, after they had cooled the layers were separated by means of a dynamometer of the TsNIKZ (Central Scientific Research Institute of the Leather-footwear Industry). The experimental data are given in Figs. 1-5 and Table 2. The results interpreted in terms of the diffusion theory are given. With increasing molecular weight the adhesion of each of the copolymers decreased to a certain limit of the molecular weight (300,000 - 350,000). With still higher molecular weight it remained approximately constant. With increasing temperature, adhesion of the fractions increased and attained almost the cohesion stability of the polymer fraction. The temperature at which this stability was attained was lower with lower molecular weight. If the glued sample was not heated, adhesion of the copolymers to the polyamide depended only little on the polarity of the copolymer. Heated glued samples were dependent on polarity. With decreasing content of polar groups adhesion increased. The weaker adhesion of the more strongly polar copolymers to the strongly polar polyamide is explained by a purely kinetic effect, i. e., by the low flexibility of the macromolecules

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Adhesion of Polymers. VI. Effect of the Molecular S/190/60/002/005/002/015  
Weight of Butadiene Acrylonitrile Copolymers B004/B067  
of Different Polarity on Adhesion to Polar and  
Apolar Substrate

of such polymers and the intensive cross-linking that suppresses diffusion. The adhesion of commercial butadiene acrylonitrile copolymers which are not separated into fractions, to polyamide in non-heated glued samples did not depend on the content of polar groups but on the content of fractions of different molecular weight. At higher temperatures, adhesion depended on polarity. The adhesion of the copolymers to the apolar substrate (polyisobutylene) is low and depends neither on polarity and molecular weight nor on temperature. There are 5 figures, 2 tables, and 18 references: 15 Soviet and 3 British. ✓

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii im.  
M. V. Lomonosova  
(Moscow Institute of Fine Chemical Technology imeni  
M. V. Lomonosov)

SUBMITTED: December 30, 1959

Card 3/3



S/190/60/002/011/003/027  
B004/B060

AUTHORS: Gul', V. Ye., Chernin, I. M.

TITLE: The Mechanism of the Transition From Forced Elastic to High-elastic Rupture

PERIODICAL: Vysokomolekulyarnyye soyedineniya, 1960 Vol. 2, No. 11, pp. 1613 - 1615

TEXT: The authors took cinematographic pictures in the polarized light to study the transition in the rupture mechanism of polymers in the vitrified state to the mechanism in the high-elastic state. The test specimen used in the work concerned was polyethylene terephthalate, whose amorphous state was examined by X-ray analysis. The authors' method consisted in that the specimens were deformed by means of a dynamometer. This dynamometer was placed in a transparent thermostat chamber with parallel walls, through which the polarized light exposed the film after passing by the analyzer. The tests were made at +20° to +140°C. (The vitrification temperature of polyethylene terephthalate is 80°C). For a concentration of the stress the specimens were either prepared

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The Mechanism of the Transition From Forced Elastic to High-elastic Rupture S/190/60/002/011/003/027  
B004/B060

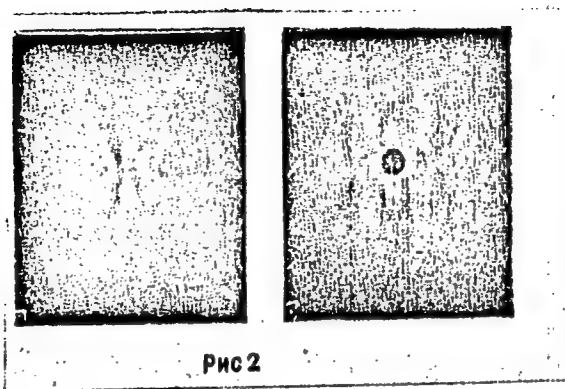
with sharp cuts or they were punched. Overstress appeared at 20°C at the initial stretching stage (Fig.2). A distinct zone then formed from oriented material, in perpendicular to the axis of deformation. The zone of orientation expanded with high stress (Fig.3). Similar phenomena were observed at 40°C and 60°C. Above vitrification temperature, however, the zones of orientation distribute more uniformly in the specimen and are then parallel to the deformation axis (Fig.6). The authors thank V. A. Kargin for a discussion. There are 7 figures and 6 Soviet references.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii  
im. M. V. Lomonosova (Moscow Institute of Fine Chemical  
Technology imeni M. V. Lomonosov)

SUBMITTED: April 6, 1960

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S/190/60/002/011/003/027  
B004/B060



PHC 2

Fig. 2

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S/190/60/002/011/003/027  
B004/B060

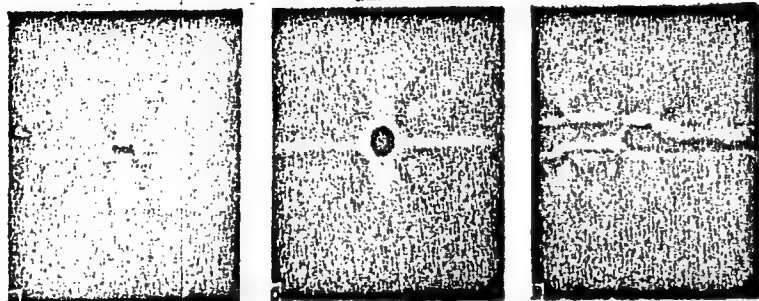


Fig. 3

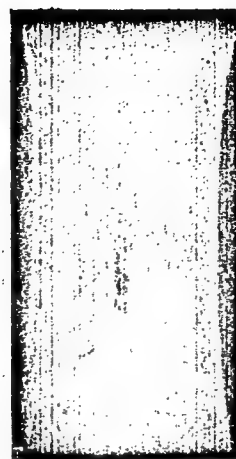


Fig. 6

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S/190/60/002/011/004/027  
B004/B060

AUTHORS: Gul', V. Ye., Kovriga, V. V., Yeremina, Ye. G.

TITLE: Study of the Characteristics of Stability of Polymers<sup>1</sup> at  
High Rates of Deformation<sup>16</sup>

PERIODICAL: Vysokomolekulyarnyye soyedineniya, 1960, Vol. 2, No. 11,  
pp. 1616 - 1619

TEXT: The authors wanted to subject polymers to mechanical tests under conditions giving rise to anomalies in comparison to the normal behavior of solid bodies. For this purpose they worked out a dynamometer permitting deformation rates of from 470,000 to 2,700,000 mm/min; the temperature of the dynamometer was kept constant by a thermostat. The curve "stress as a function of time" was recorded by means of an МПО-2, (MPO-2) loop oscilloscope. The test temperatures ranged between -20° and 100°C. Specimens of nonfilled CKH-26 (SKN-26) rubber, polyethylene<sup>6</sup> (molecular weight 18,000 - 25,000) and polyamide<sup>6</sup> were examined. The curves obtained were reconstructed into "deformation as a function of stress", and the following was determined from them: 1) breaking stress  $\sigma_b$ , 2) the relative

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Study of the Characteristics of Stability of  
Polymers at High Rates of Deformation

S/190/60/002/011/004/027  
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prolongation on rupture, 3) time of rupture  $\tau_b$ , and 4) the deformation work (calculated from the area of the curve "deformation as a function of stress"). Anomalies were observed at deformation rates between 470.000 and 2.700 000 mm/min. The nonmonotonic change of  $\sigma_b$ , of the relative prolongation, and of  $\tau_b$  had a likewise nonmonotonic change of the deformation work as a result. Maxima between 0 - 20°C and minima between -20° and +100°C were observed with the SKN-26 vulcanizate. With rising temperature the deformation curves shifted toward higher temperatures. A comparison of polymers based on measurements made at different temperatures, may lead to the wrong conclusions due to intersection of these curves. As contrasting therewith, an almost constant value of  $(2.7 \pm 0.1) \cdot 10^4$  for polyethylene, and of  $(4.0 \pm 0.1) \cdot 10^4$  for polyamide was found for the ratio  $\sigma_m / \tau_b$ , where  $\sigma_m$  is the mean value of stress. For SKN, however, the ratio fluctuated between  $3 \cdot 10^3$  and  $4 \cdot 10^3$ . There are 3 figures, 1 table, and 1 Soviet reference.

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Study of the Characteristics of Stability of  
Polymers at High Rates of Deformation

S/190/60/002/011/004/027  
B004/B060

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii im.  
M. V. Lomonosova (Moscow Institute of Fine Chemical  
Technology imeni M. V. Lomonosov)

SUBMITTED: April 7, 1960

Card 3/3

15 (8), 28 (5)

AUTHOR: Gul', V. Ye.

S/032/60/026/01/005/052  
B010/B123

TITLE: Answers to the Inquiry About the Test Methods of the Physical and Mechanical Properties of Plastics

III

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol 26, Nr 1, pp 13 - 18 (USSR)

ABSTRACT: The development of new plastic material for constructional engineering has to be based on the combination of chemistry and constructional engineering. Old and new test methods have to be applied and adequately revised. Thus, an evaluation of the physical and mechanical properties of plastics in connection with the chemical structure should be made possible. The following properties should be investigated for determining this connection: 1. deformability, 2. strength characteristics and 3. characteristic temperatures determining a change in properties. The evaluation of deformability is based most suitably on the value of the modulus. Of crystalline polymers the tension leading to the recrystallization process and the deformation rate have to be stated as well. The latter should be standardized. Plastic films are tested best by

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Answers to the Inquiry About the Test Methods of the Physical and Mechanical Properties of Plastics III S/032/60/026/01/005/052 B010/B125

dynamometers of the type Polyani (Ref 13), Dogadkin and Gul' (Ref 14) and others (Ref 14). For determining the durability the technique worked out by S. N. Zhurkov et al. (Ref 16) is recommended. The determination of the stress-deformation diagram (and of the pertaining characteristics), and the test of stress relaxation and creep are considered to be the most important tests of plastics. The author and V. V. Kovrigin designed an apparatus for determining the stress-deformation diagram (for higher deformation rates than provided by GOST 4649-55) which was constructed in the institute mentioned under "Association". The dynstat method can be applied for determining static bending strength, for impact tests comparing two plastics the method worked out in the Institut vysokomolekulyarnykh soedineniy AN SSSR (Institute for High Molecular Compounds of AS USSR) (Ref 23) is preferable. It is emphasized that at present no standards at all for the fatigue test of plastics exist in the USSR and that applying the standards of rubber tests (GOST 422-41, 266-53, and 261-53) would be unsuitable. As a physically sound method for testing hard plastics

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Answers to the Inquiry About the Test Methods of the S/032/60/026/01/005/052  
Physical and Mechanical Properties of Plastics III B010/B123

with respect to durability, the method worked out in the above-  
mentioned institute under the direction of Ye. V. Kuvshinskiy ✓  
(Ref 23) is recommended. There are 32 references, 24 of which  
are Soviet.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii im.  
M. V. Lomonosova (Moscow Institute for Fine Chemical Technology  
imeni M. V. Lomonosov)

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69879

5.3830

S/032/60/026/04/28/046  
B010/B006

AUTHORS: Chernin, I.M., Gul', V.Ye.

TITLE: Investigation of the Destruction Process of Polymers by Time-lapse and Color-film Motion Pictures in Polarized Light

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 4, pp. 484-487

TEXT: A method of investigating the mechanical properties of transparent polymers by time-lapse and color-film motion pictures in polarized light is described. Valuable advice by Academician V.A. Kargin was taken into account when working out the method. The specimens were stretched in a RMM-60<sup>2</sup> tensile-testing machine for elastomers in a thermostated glass chamber (Fig. 2). PPV-4 polyvinyl polaroids (diameter 300 mm) were used as polarizer and analyzer. A specimen of polymethacrylmethacrylate (a glassy linear polymer) showed overstresses in the zone of defect immediately after beginning deformation, which becomes apparent from a deepening of the darkening. In the course of prolonged elongation, this darkening spreads vertically to the direction of applied stress (Fig. 3). In vulcanized rubber specimens, overstressing occurs in the direction of stress, and not at right angles to it (Fig. 4). In polyethyleneterephthalate specimens,

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Investigation of the Destruction Process of Polymers by S/032/60/026/04/28/046  
Time-lapse and Color-film Motion Pictures in Polarized BO10/BO06  
Light

overstressing spreads similar to polymethylmethacrylate at lower temperatures, while at 160-180° the destruction character resembles that of vulcanized rubber. The destruction character of a polyethyleneterephthalate specimen heated to 100° lies between that of a glassy polymer and a polymer with marked three-dimensional structure. There are 5 figures and 4 Soviet references.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii im. M.V.  
Lomonosova (Moscow Institute of Fine Chemical Technology imeni  
M.V. Lomonosov)

Card 2/2

GUL', V.Ye.; KOVRIGA, V.V.; KAMENSKIY, A.N.

Investigation of the spontaneous shrinking of polymers  
with a developed space structure in the course of their  
rupturing. Dokl.AN SSSR 133 no.6:1364-1367 Ag '60.

(MIRA 13:8)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii im.  
M.V.Lomonosova. Predstavleno akad. V.A.Karginya.  
(Polymers)

GUL; V ye

PHASE I BOOK EXPLOITATION

SOV/5590

42-

- Konferentsiya po poverkhnostnym silam. Moscow, 1960.

Issledovaniya v oblasti poverkhnostnykh sil; sbornik dokladov na konferentsii po poverkhnostnym silam, aprel' 1960 g. (Studies in the Field of Surface Forces; Collection of Reports of the Conference on Surface Forces, Held in April 1960) Moscow, Izd-vo AN SSSR, 1961. 231 p. Errata printed on the inside of back cover. 2500 copies printed.

Sponsoring Agency: Institut fizicheskoy khimii Akademii nauk SSSR.

Resp. Ed.: B. V. Deryagin, Corresponding Member, Academy of Sciences USSR; Editorial Board: N. N. Zakhavayeva, N. A. Krotova, M. M. Kusakov, S. V. Norpin, P. S. Prokhorov, M. V. Talayev and G. I. Fuks; Ed. of Publishing House: A. L. Bankvitser; Tech. Ed.: Yu. V. Rylina.

PURPOSE:.. This book is intended for physical chemists.

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Studies in the Field of Surface Forces (Cont.)

4.2  
SOV/5590

COVERAGE: This is a collection of 25 articles in physical chemistry on problems of surface phenomena investigated at or in association with the Laboratory of Surface Phenomena of the Institute of Physical Chemistry of the Academy of Sciences USSR. The first article provides a detailed chronological account of the Laboratory's work from the day of its establishment in 1935 to the present time. The remaining articles discuss general surface force problems, polymer adhesion, surface forces in thin liquid layers, surface phenomena in dispersed systems, and surface forces in aerosols. Names of scientists who have been or are now associated with the Laboratory of Surface Phenomena are listed with references to their past and present associations. Each article is accompanied by references.

TABLE OF CONTENTS:

Zakhavayeva, N. N. Twenty-Five Years of the Laboratory of Surface Phenomena of the IFKhan SSSR (Institute of Physical Chemistry of the Academy of Sciences USSR)

3

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Studies in the Field of Surface Forces (Cont.)

SOV/5590

I. GENERAL PROBLEMS OF SURFACE FORCES

Deryagin, B. V. Surface Forces and Their Effect on the Properties of Heterogenous Systems

11

Kusakov, M. M., and L. I. Mekonitskaya. Investigation of the State of Bound Water in Oil Traps

17

Shcherbakov, L. M. General Theory of Capillary Effects of the Second Order

28

Dukhin, S. S. Surface Forces of a Diffusive Nature Close to Liquid Interfaces

38

II. POLYMER ADHESION

Korotova, N. A., and L. P. Morozova. Investigation of the Adhesive Binding of Polymers by Means of the Luminescence Method

48

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Studies in the Field of Surface Forces (Cont.)

SOV/5590

Voyutskiy, S. S., V. L. Vikula, V. Ye. Gul', and Ho Yün-tsui. Effect of Molecular Weight, Polydispersion, and Polarity of High Polymers on Their Adhesion to High Molecular Substrata

55

Metsik, M. S. Role of Surface Forces in Mica Crystals

66

Smilga, V. P. Double Layer on the Boundary of Solids Characterized by a Donor-Acceptor Bond

76

Krotova, N. A., and L. P. Morozova. Applying Infrared Spectroscopic Methods to Study the Interaction Between an Adhesive and Its Lining (Polymer - Glass)

83

Deryagin, B. V., and I. N. Aloynikova. Measurement of the True Density of a Double Electric Layer at the Metal - Dielectric Boundary of Separation

89

Card 4/8

15 1123  
5 64100

31897  
S/643/61/000/000/002/007  
EO40/E485

AUTHORS: Voyutskiy, S.S., Vakula, V.L., Gul', V.Ye.,  
Ho Yun-tsui

TITLE: Effect of molecular weight, polydispersiveness and  
polarity of high polymers on their adhesion to high-  
molecular substrata

SOURCE: Konferentsiya po poverkhnostnym silam. Moscow, 1960.  
Issledovaniya v oblasti poverkhnostnykh sil; sbornik  
dokladov na konferentsii. Moscow, Izd-vo AN SSSR, 1961.  
At head of title: Akademiya nauk SSSR. Institut  
fizicheskoy khimii. 55-65

TEXT: Because in previous studies of the adhesive properties of  
high polymers, no differentiation was made of the effects on  
adhesion of the two individual factors on which it depends, i.e.  
molecular weight and polarity, an investigation was carried out at  
the Moscow Institute of Fine Chemical Technology imeni  
M.V.Lomonosov on the effect of the molecular weight at constant  
polarity, of the effect of the polarity at a constant molecular  
weight, as well as of the effects of other factors on the adhesion  
Card 1/5

X

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S/643/61/000/000/002/007  
E040/E485

Effect of molecular weight ...

of polymers to polar and non-polar substrata. Furthermore, the results obtained were compared with data obtained for polydisperse products. The investigation was made on specimens of butadiene-acrylonitrile copolymers with various concentrations of the polar component in the macro-molecule (nitrile rubbers CKH-18 (SKN-18), CKH-26 (SKN-26) and CKH-40 (SKN-40)). Molecular weight was determined by the light dispersion method, while the acrylonitrile content, which varied from about 19 to 40%, was calculated from the nitrogen content. A polyamide substratum was used in the tests designed to elucidate the effect of molecular weight on adhesion and a polybutylene substratum was used in examining the effect of polarity. Adhesion between the various polymer fractions and the substrata was determined at a constant rate of separation (0.3 cm/sec) using an apparatus designed at the TsNIKZ (Ref.9: S.S.Voyutskiy, V.M.Zamaziy, Kolloidn. zh., 1953, v.15, 407 and Ref.11: A.I.Shapovalova, S.S.Voyutskiy, A.P.Pisarenko. Kolloidn. zh., 1956, v.18, 485). Test specimens were prepared as described previously by two of the present authors (Ref.3: Vysokomolekul. soyedineniya, 1960, v.2, 51). Some specimens were also cured under load at the temperatures of

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Effect of molecular weight ...

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S/643/61/000/000/002/007  
EO40/E485

50, 100, 150, 175 and 200°C for 30 minutes, cooled to room temperature and then tested for the dependence of adhesion on the specimen temperature. It was found that the adhesion of butadiene-acrylonitrile copolymers to polyamide substrata diminishes with rising molecular weight of the copolymer and then remains constant for molecular weights exceeding 300 to 350 thousand. The adhesion of all specimens was found to be considerably improved with rising curing temperature. This applies especially to the lower molecular weight fractions (transition from adhesive to cohesive bond type). Curves were plotted for the variation of adhesion of butadiene-acrylonitrile copolymers to polyamide substratum as a function of the concentration of the polar groups (acrylonitrile). It was found that, at room temperature, the strength of adhesion depends little on the polar groups. However, if the temperature of the contact is raised to 150°C, adhesion drops sharply with increasing polarity and, conversely, the strength of adhesion rises rapidly with curing temperature as the polarity of the specimens is decreased. A theoretical explanation is given of this dependence. Adhesion data from tests  
Card 3/5

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S/643/61/000/000/002/007

EO40/E485

Effect of molecular weight ...

on polyamide base of various fractions of butadiene-acrylonitrile copolymers were compared with those obtained in parallel tests of the adhesion of non-fractionated products (polydisperse). It was found that, in the first case, adhesion of contacts at room temperature is practically independent of polarity but that, in the second case of polydisperse fractions, the strength of adhesion diminishes with increasing content of the polar acrylonitrile group. At elevated temperatures, the effect of polarity on adhesion is identical for non-fractionated products and the fractions with molecular weight of about 320000. An examination of the influence of the nature of substrata on the adhesion of polymers of different molecular weights and polarities showed that the adhesion of polar adhesives to non-polar substrata is rather low and is independent of the molecular weight and polarity of the adhesive and the temperature of the contact. V.I.Tsvetkov and V.Petrova are mentioned in the article in connection with their contributions in this field. There are 8 figures, 2 tables and 32 references: 22 Soviet-bloc, 3 Russian translations from non-Soviet-bloc publications and 7 non-Soviet-bloc. The four most recent references to English language publications read as follows:  
Card 4/5

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S/643/61/000/000/002/007  
E040/E485

Effect of molecular weight ...

Ref.13: W.G.Forbes, L.A.McLeod. IRI Transactions, v.34, 1958, 154;  
Ref.16: A.Aitken, R.M.Barrer. Trans. Faraday Soc., v.51, 1955, 116;  
Ref.19: F.Bueche. J. Chem. Phys., v.20, 1952, 1959;  
Ref.30: J.Rutzler. Adhesives Age, 1959, v.2, no.6, 39; 1959, v.2,  
no.7, 28.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii  
im. M.V.Lomonosova (Moscow Institute of Fine Chemical  
Technology imeni M.V.Lomonosov)

X

Card 5/5

BARTENEV, G.M., doktor khimicheskikh nauk; GUL', V.Ye., doktor khimicheskikh nauk

Methods of determining the strength of polymers. Zhur.VKHO 6 no.4:  
394-403 '61. (MIRA 14:7)

(Polymers--Testing)

B/007/62/000/001/001/002  
D204/D307

AUTHORS: Mladenov, I., Nikolinski, P., Gul', V. and Petrov, N.

TITLE: The influence of branching of polymeric chains on their combining power in block and in solution

PERIODICAL: Referativnyy byulleten' bolgarskoy nauchnoy literatury. khimiya i khimicheskaya tekhnologiya, no. 1, 1962, 6, abstract no. 16, (Doklady BAN, 14, 1961, book 6, 615 - 618)

TEXT: Polymethyl methacrylate (PM) and polystyrene (PS) with branched chains were tested for mutual compatability and their combining power with polyvinyl acetate (PVA) and natural rubber, both in block form and in solution. The combining power in solutions (benzene and chloroform) was assessed by the measurement of specific viscosity. PM possessing branched chains was far more

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The influence of branching of ...

B/007/62/000/001/001/002  
D204/D307

compatible with PVA, PB with branched chains and natural rubber, then was the linear polymer. A new method is described of determining the compatability in block form, consisting of selective swelling and optical examination. Films of the materials under test are saturated with vaporized solvent, in a chamber, and are observed microscopically from time to time. Bright patches may be observed if the specimen is not homogeneous. It was found by the above method that branched chain PMM does not exhibit any appreciable compatability with PVA, in comparison with linear PMM. This increased reactivity is ascribed to steric factors. There are 2 figures. [Abstractor's note: Complete translation]

Card 2/2

VIL'NITS, S.A., GUL', V.YE.

The prospects of splitting and tissue removal of rubber and waste products in the production of commercial rubber articles.

Report submitted for the 4th Scientific research conference on the chemistry and technology of synthetic and natural rubber, Yaroslav, 1962

GUL', V. Ye., KOVRIGA, V.V., VASSERMAN, A.M.

Effect of supermolecular structures on the strength of polypropylene.

Report presented at the 13th Conference on high-molecular compounds  
Moscow, 8-11 Oct 62

S/138/62/000/010/007/008  
A051/A126

AUTHORS: Gul', V.Ye., Lushcheykin, G.A.

TITLE: A method of investigating electric charges occurring in repeated deformations of vulcanizates

PERIODICAL: Kauchuk i rezina, no. 10, 1962, 51 - 52

TEXT: A method has been developed to determine the magnitude and sign of electric charges forming in repeated deformations of polymers at various temperatures (from -100 to +200°C), and deformation frequencies from 16 to 14 cps. The suggested method, using the instrument shown in Figure 1, can also be applied to investigate the relation of polymer deformation to temperature and deformation frequency. The charge generated in one cycle was determined accumulated in deformation on electrodes and sample. The 30-53 (EO-53) AC oscillograph was used for this purpose, with an additional amplifier (Fig. 2). The magnitude and sign of the charge were estimated from a curve on the oscillograph. The charge magnitude was determined in two different ways: a) by measuring the maximum pulse V, in volts and calculating the charge magnitude, from the formula:  $Q = CV$  (C -

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S/138/62/000/010/007/008  
A051/A126

A method of investigating electric charges ....

capacitance of the ingoing circuit); b) by measuring the energy  $W$ , entering the system per cycle from the transmitter, consumed either for the charge of the ingoing capacitance  $C$ ,  $W = CV^2 = \frac{Q^2}{C}$ , or for the heating of the total resistance circuit:  $Z$ :  $W = \frac{U^2}{fZ}$ , where  $U$  is the acting value of the voltage,  $v$ ;  $f$  - frequency, cps. From the latter two formulae an expression for calculating the charge per cycle is derived:  $Q = U \sqrt{\frac{C}{fZ}}$ . Similar results are obtained from both methods. There are 3 figures.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii im. M.V. Lomonosova (Moscow Institute of Fine Chemical Technology im. M.V. Lomonosov)

Card 2/2 Z

33387

S/190/62/004/002/018/021  
B101/B110

15 1120

AUTHORS: Voyutskiy, S. S., Gul', V. Ye., Chang Yin-hsi, Vakula, V. L.

TITLE: Adhesion of polymers to silicate glass

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 4, no. 2, 1962, 285-293

TEXT: The authors studied the adhesion of polyisobutylene with different molecular weights (MW), type П-20, (P-20), П-85 (P-85), П-118 (P-118), П-200 (P-200), of natural rubber (NR) of polyisoprene CKH (SKI), of butadiene acrylonitrile rubbers type CKH-18 (SKN-18), CKH-36 (SKN-36), CKH-40 (SKN-40), of polychloroprene (PCP) and of chloro sulfopolyethylene (CSPE) to ordinary window glass. Films on percale base were produced from an 8 - 10% solution of the elastomers in benzene. After removing the solvent these films were rolled on glass. After 30 min (with specimens subjected to heat treatment 30 min after the cooling) the force required for defoliation was measured by an adhesiometer of the TsNIKZ. For SKN-40 and P-58 it was found that adhesion becomes independent of the film thickness as soon as the thickness reaches about 0.0125 - 0.0150 g/cm<sup>2</sup>. With PCP, however, adhesion increases with increasing film thickness since

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this elastic polymer is strongly stretched in defoliation. Adhesion of P-118 and SKN-40 as a function of contact time (50 hr at 100°C) first increased rapidly and then slowly approached a final value. In the apolar P-118 whose molecules are more flexible than those of SKN-40 the final value was reached more rapidly. Adhesion as a function of temperature (heating to 160 - 180°C) gave exponential curves for NR and SKN-40 while adhesion of P-85 and PCP approached a final value. CSPE showed an S curve. The retarded increase in adhesion at 140 - 180°C can be explained either by the fact that a final value is reached or by thermal decomposition of CSPE. The following values are given:

		defoliation resistance, g/cm	
		non heated	heated for 30 min at 100°C
(A) denotes adhesive separation,	P-118	162 (A)	223 (A)
	NR	48 (A)	72 (A)
(C) denotes cohesive separation.	SKI	238 (A)	285 (C)
	PCP	980 (A)	1110 (A)
	CSPE	136 (A)	390 (A)
	SKN-40	157 (A)	159 (A)

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Hence the adhesion of elastomers to glass shows the same order as was observed in the adhesion to cellophane and polyamide films. Adhesion of polyisobutylene increased and defoliation became cohesive as soon as the MW decreased to approximately 20,000. It is concluded that adhesion between elastomers and glass is due to diffusion processes of macromolecule ends into the glass or to penetration of the polymer into microcracks of the glass surface. A. Ya. Korolev, M. S. Aslanova, and A. G. Shvarts are mentioned. V. A. Kargin is thanked for discussions. There are 8 figures, 1 table, and 24 references: 14 Soviet and 10 non-Soviet. The four most recent references to English-language publications read as follows: W. A. Weyl, Symp. "Adhesion a. Adhesives", N. Y., J. Wiley & Sons, 1954, p. 36; N. M. Trivisonno, L. H. Lee, S. M. Skinner, Industr. and Engng. Chem., 50, 912, 1958; J. E. Rutzler, Adhesives Age, 2, 39, 1959; D. Taylor, J. E. Rutzler, Industr. and Engng. Chem., 50, 928, 1958. /

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